MASTER OF MILITARY STUDIES

Designing the Desired State: A Process and Model for Operational Design

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

Major Jonathan M. Stofka

AY 09-10

Mentor and Oral Defense Committee Member: Francis H. Marlo, PhD
Approved: _____
Date:_____

Report Documentation Page

Form Approved
OMB No. 0704-0188

Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.

1. REPORT DATE **2010**	2. REPORT TYPE	3. DATES COVERED **00-00-2010 to 00-00-2010**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Designing the Desired State: A Process and Model for Operational Design	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Marine Corps University,Command and Staff College,Marine Corps Combat Development Command,Quantico,VA,22134**	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**Same as Report (SAR)**	**36**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Executive Summary

Title: Designing the Desired State: A Process and Model for Operational Design

Author: Major Jon Stofka, United States Marine Corps

Thesis: The irregular wars fought in Iraq and Afghanistan since 2001 have highlighted the need for a new approach to planning when facing ill-structured problems. Operational design is a suitable approach; however, implementation has fallen short and begs for a simple model and process for explanation.

Discussion: The irregular wars in Iraq and Afghanistan have highlighted the need for a new planning process. Irregular warfare has proved to be much more complex than conventional warfare. The Marine Corps Planning Process (MCPP) has proven insufficient in dealing with the interactive complexity found in irregular warfare. Planners using MCPP have difficulty understanding interactively complex situations, defining the root problems, and devising innovative solutions. MCPP is an analytical decision-making process whose purpose is analyzing the mission, developing several courses of action (COAs), and choosing the optimal COA. Planners did not develop MCCP with the purpose of understanding interactively complex situations, defining problems, and devising innovative solutions. Toward the end of the Vietnam War, urban planners began to realize the limitations of applying analytical methods to solve interactively complex problems. They found there were two basic types of problems: tame problems and ill-structured problems. They found that it was important to understand the type of problem they faced, so that they could apply the proper solution method. Whereas tame problems lend themselves to analytical approaches, they found that ill-structured problems require a synthetic approach, similar to the design approach that architects apply. In 2005, faced with mounting insurgencies in both Iraq and Afghanistan, the Army began to experiment with operational design and the Marine Corps has recently followed suit. Both approaches have had implementation shortfalls, mostly because they are overly complicated and lack a defined process. A simple, comprehensible design process that planners can apply at all levels is required for the successful implementation of design.

Conclusion: The irregular wars in Iraq and Afghanistan have shown that MCPP is inadequate at handling ill-structured problems. Planners must understand whether they are facing a structured or ill-structured problem, so they can apply the proper solution method. Ill-structured problems require a synthetic problem solving approach, such as design, to understand the interactively complex situation, define the root problems, and devise innovative solutions. The Army and Marine Corps have recently started the transition to operational design; however, both approaches have implementation problems, mostly stemming from a lack of a simple model and process. This paper details a simple, non-procedural design process that focuses on designing the desired state. This process is easy to comprehend and can be used by planners at all levels.

Table of Contents

Illustrations

Preface

While serving as a Forward Air Controller (FAC) with 3rd Battalion, 7th Marines, in support of Operation Iraqi Freedom II in 2004, I realized how complex the counterinsurgency fight could be. I was with Lima Company in Husaybah, Iraq, a large town south of the Euphrates River that included a major border crossing with Syria. Lima Company's task was to conduct security and stabilization operations in vicinity of Husyabah, as well as control a major border crossing between Iraq and Syria. The large number of diverse actors in Lima Company's battle space contributed greatly to the complexity of the operating environment. Major actors included the Iraqi National Guard, the Iraqi Police, the Iraqi Border Police, four major tribes, former Ba'ath Party members, foreign fighters crossing from Syria, numerous smuggling rings and other criminal networks. All of the actors appeared to have their own competing agendas and interactions among the actors were difficult to understand. The area was historically corrupt, and criminal activity centered on smuggling goods, such as sheep, gas, and cigarettes, across the border to Syria. When the former regime elements lost political power after the fall of Baghdad, the competition to fill the power vacuum presented an extremely unstable and violent environment.

We did not have a good understanding of this complex operating environment before conducting operations in Husaybah, and months passed before we began to understand the complex nature of our problem. Prior to leaving Husaybah, the Lima Company Commander tasked me with writing the after action report for the deployment. I solicited input from all of the platoon commanders and other billet holders within the company. Upon compiling the input, I realized that collectively we had a great deal of knowledge that had not become common

knowledge during our daily meetings. This knowledge, when properly mined, would have led to a better understanding of the problem, as well as innovative solutions.

At Marine Corps Command and Staff College, I was exposed to operational design and realized its potential for understanding complex problems not only prior to, but during, a campaign. Drawing from my experience with Lima Company, I also realized that design was not just a tool for combatant commanders, but also had merit at the battalion and company levels. Design, however, lacked a process, making it difficult to understand. For the implementation of design to be successful, a simple, comprehensible design process that planners can apply at all levels is required. The development of this process is the main purpose of this paper.

Introduction

The United States military has recently faced a crisis in its planning process and has turned to Operational Design for the answer. The crisis stems from the inability to understand the complex problems the insurgencies of Iraq and Afghanistan presented using current planning methods. In these insurgencies, understanding the situation and defining the problems proved the largest challenges. Looking at theses problems through the lens of operational design allows planners to better understand the situation, define problems, develop innovative solutions, and describe a suitable desired future state.

The Marine Corp's initial attempt to incorporate design into the Marine Corps Warfighting Publication (MCWP) 5-1, *Marine Corps Planning Process,* has been marred with misunderstanding and controversy. The draft MCWP 5-1 contains a mere two-page introduction to design and simply changes "Mission Analysis" to "Problem Framing," without a clear understanding of what design is or how to accomplish it. For fear of appearing procedural, no process for design is given. This lack of a process has left planners confused and without direction. In December 2009, the Marine Corps Command and Staff College used the Draft MCWP 5-1 during a planning exercise for students called Pacific Challenge. This planning exercise served as the first introduction to design for most students. Most students were left confused as to what design is and how to accomplish it. Without a process provided by MCWP 5-1 on how to design, planners simply reverted to performing mission analysis per the former MCWP 5-1.

The irregular wars fought in Iraq and Afghanistan since 2001 have highlighted the need for a new approach to planning against ill-structured problems. Operational design is a suitable approach; however, implementation has fallen short and begs for a simple model and process for

explanation. This paper begins with the need for operational design by showing how the

irregular wars in Iraq and Afghanistan are more complex than conventional wars and therefore

require a new approach to planning. The paper then explains why the Marine Corps Planning

Process (MCPP) fails to handle this added complexity. Next, the paper discusses new

approaches to planning developed toward the end of the Vietnam War that allow planners to

understand, distinguish, and solve ill-structured problems. The planning crisis of the current

irregular wars has led the military to adopt these approaches in the form of operational design.

Then, the paper describes the implementation failures of operational design. Finally, a simple,

comprehensible design process that planners can apply at all levels is proposed.

Need For Design

The irregular wars fought in Iraq and Afghanistan since 2001 have highlighted the need

for a different approach to planning. These irregular wars are extremely complex in character

and do not lend themselves to the current planning process. Often the most difficult aspects of

these conflicts involve defining the problems. By demonstrating how irregular warfare is more

complex than conventional warfare, planners begin to see the need for a design approach to

planning that allows them to understand the complex problems of irregular warfare.

Before comparing the complexity of irregular warfare to conventional warfare, it is first

necessary to understand the term complexity. There are two main types of complexity: structural

complexity and interactive complexity.[1] Structural complexity relates to the number of parts in a

system, while interactive complexity relates to how these parts interact.

In conventional warfare, the combat Line of Operation (LOO) is often decisive and is the

main, if not sole, focus of the military. Combat operations are what the military trains to, excels

at, and where it first looks for solutions. Irregular warfare, on the other hand, is a fight over the legitimacy from the people, not solely a fight against the enemy. In irregular warfare, the military needs to consider not only the combat LOO, but also promotion of governance, essential services, economic development, training and advising host nation security forces, and information LOOs.[2] Combat operations often take a secondary or supporting role to these other LOOs. In irregular warfare, there are not only more LOOs, but the LOOs themselves are also interdependent. In conventional warfare, the military focuses on the opposing military force. In irregular warfare, the military needs to have a deep understanding of the opposing armed groups, the people, the host nation's government, and a slew of other actors that all interact with one another. This understanding requires a comprehension of the history, culture, language, religion, demographics, business, law, and security of the given area. This understanding is not nearly as important in a conventional war, where the primary focus is on imposing one's physical will upon the enemy.

Irregular warfare is clearly more complex than conventional warfare based on the above discussion showing that irregular warfare has an increased number of LOOs, actors, and interactions between LOOs and actors. Planners need a design approach to planning that allows them to understand and define the complex problems associated with irregular warfare. The following section describes the current planning process and explains why it fails to handle complex problems like irregular warfare.

Current Planning Process

The current planning process is an analytical method based on a rational decision-making process that searches for an optimal solution among multiple options. Marine Corps Warfighting

Publication (MCWP) 5-1, *Marine Corps Planning Process* (MCPP) describes the procedural six-step planning process. The six steps are Mission Analysis, Course of Action (COA) Development, COA War Game, COA Comparison and Decision, Orders Development, and Transition. MCPP is procedural and product-oriented. This focus on procedures and products stifles creativity, innovation, and a true understanding of the situation at hand. Often planners using the process are too quick to start planning and making products before understanding the problem. This rashness often leads to solving the wrong problem in complex situations where the root problems are difficult to understand.

MCPP is not meant to deal with problems as complex as those found in irregular warfare. Problem solvers developed this process to find an optimal solution given a number of choices. It is not possible to find an optimal solution to a problem so complex that it requires six interdependent LOOs and has multiple actors interacting with one another. It is not clear how planners would even develop multiple COAs in such a scenario. These types of problems are intractable and require different methods for solution. Herbert Simon states that humans do not solve problems based on a rational decision-making process, such a MCPP, which searches for an optimal solution. Instead, humans search for a solution that satifices using a bounded rationality.[3]

Toward the end of the Vietnam War, the nation's last large-scale irregular war, psychologists and planners of complex problems, such as urban planners, began to realize the limitations of analytical decision-making processes in solving complex problems. In 1972, Horst Rittel coined the terms "tame" and "wicked" problems.[4] Rittel, an urban planner and professor at the University of California-Berkeley, recognized the inability of analytical methods to solve these complex, "wicked" problems. Planners need to identify the type of problem they are

dealing with and match it with an appropriate decision-making approach. Planners can use the descriptions and characteristics of these problem types, given below, to aid with identification and ensure they are using the proper method.

Tame Problems

Tame problems are problems that are well-structured and are typically comprised of structurally complex, linear systems where the sum of the parts equals the whole. They have a well-defined problem and a well-defined goal.[5] Planners solve tame problems with analytical methods. They can also use intuition to solve tame problems, especially when time is critical and when their experience and judgment allows them to see patterns that they recognize in the problem. These problems may be tedious to solve, but planners understand the problem and the goal.

An example of a tame problem from the planning world would be the mission planning of a helicopterborne assault. Planners understand the problem, which resembles a series of math problems. Planners are looking for routes, landing zones, fuel plans, load plans, and similar information. They also understand the goal, given in terms of an objective area, landing time (L-hour), and the number of troops. The problem is tedious, in terms of balancing the weight the helicopter can carry per the ambient conditions with the fuel weight required for the route and the weight of the passengers and equipment, but solvable with standard analytical methods. In such a case, planners would use MCPP to determine the objective area and decide between the means of securing the objective area. Options may include a land COA, an amphibious COA, or the helicopterborne assault detailed above.

Ill-Structured (Wicked) Problems

Ill-structured problems, also called wicked problems, are extremely difficult to define, let alone solve. Ill-structured problems consist of a series of interconnected, complex adaptive systems that display a great deal of interactive and structural complexity. These complex adaptive systems provide feedback to one another, causing the overall system to be nonlinear. In non-linear systems, the sum of the parts is not equal to the whole, meaning that planners cannot break them down into simpler parts for analysis and ignore the interactions without losing valuable information. These interactions are important, and the emergent behavior the interactions form would be lost without them. To draw the system boundary smaller and not include one of these complex adaptive systems is not practicable because the information that the subsystem provides is essential to the system of study. Rittel states that wicked problems are a "one-shot operation," meaning that once planners begin to interact with the problem, it is forever changed and they cannot return to the previous situation.[6] The stability and stabilization mission in Iraq is an example of a wicked problem. Included within the boundaries of this system are political, cultural, tribal, economic, insurgent, information systems, as well as a number of other complex systems. It is easy to see how each one of these systems affects the others and needs to be included in the overarching stability and stabilization system.

What makes these ill-structured problems so difficult to solve is wading through the interactive complexity and discovering what the root of the problem is. Planners normally think that there is one problem with one solution, which is not the case with ill-structured problems. There are normally multiple problems requiring multiple solutions. Solving a problem often reveals other problems lying in wait.

In order to solve wicked problems planners first need to define the problem(s) at hand. Albert Einstein stated, "If I were given one hour to save the planet, I would spend 59 minutes defining the problem and one minute resolving it." Defining the right problems from the outset ensures that planners focus their efforts in the proper direction. When planners fail to solve the right problem from the start, their efforts at improvement can actually make the situation worse. Russ Ackoff sums this assertion up in the following statement:

> The "righter" we do the wrong thing, the "wronger" we become. If we make a mistake doing the wrong thing and correct it, we become "wronger." If we make a mistake doing the right thing and correct it, we become "righter." Therefore, it is better to do the right thing wrong than the wrong thing right.[7]

From the above information on ill-structured problems, it is clear that to solve these ill-structured problems the planning process needs to identify the proper problem(s). It must also be systemic in nature to capture the interactions between the parts. Finally, it must be iterative because the problem continuously changes due to the nature of complex adaptive systems and the fact that solving a problem often allows additional problems to come to the forefront.

Systemic, holistic approaches are required to tackle ill-structured problems. In the 1970s and 1980s, urban and social system planners began to look at the design industries, such as architecture and engineering, for methods to solve ill-structured problems. Design involves a dialogue to form an ideation of what the client envisions. Designers use compromise and synthesis to create the ideation with interacting, competing parts. A key aspect of design is considering the interaction of parts and the harmony that exists between them.

An example would be the design of a helicopter. Engineers design helicopters by considering how all of the parts interact with one another. They cannot simply demand the best engine, the best transmission, and the best rotor blades available and design them independently

of one another. They would end up with a transmission that cannot support the engine or a helicopter that it too heavy to fly.

Design Implementation Failures

The U.S. Army began experimenting with design during the Unified Quest exercises in the spring of 2005. Since then, Army planners have written a number of manuals and papers on the subject and are integrating design into their Field Manual on planning, currently scheduled for a spring 2010 release. The Marine Corps has followed suit and released a draft version of MCWP 5-1 attempting to integrate design into MCPP. Design is a leap forward from MCPP in terms of understanding ill-structured problems. However, both services fail to implement design, mainly because of their inability to explain a simple design process.

Marine Corps

The Marine Corps' attempt to integrate design into MCCP is severely flawed. The Marine Corps simply renames the old mission analysis step as "problem framing" and includes a mere two-page, confusing description of the characteristics of design. The main problem with this approach is that design is more of a matter of synthesis than analysis, and the former mission analysis step, as the name suggests, is all analysis. Analysis breaks the problem down into pieces and studies them individually. The interactions between the parts are lost, along with the emergent behavior formed by the interacting parts. Analysis is included in design because the planners need to understand the individual parts, but the emphasis is on synthesis and building the whole out of the interacting parts. In this light, the Marine Corps approach is more akin to operational demolition than operational design.

The draft version of MCPP describes design in a complicated fashion that leaves the reader wondering what design is. The draft states that, "Design does not end with Problem Framing, because problems normally evolve over time."[8] Readers wonder if this statement means that design encompasses all of MCPP or if it is just "problem framing" done iteratively. It shows design as a mysterious process that exists in the commander's "visualization,"[9] but offers no suggestions on how it gets there. In this regard, the draft lists no process for how to design.
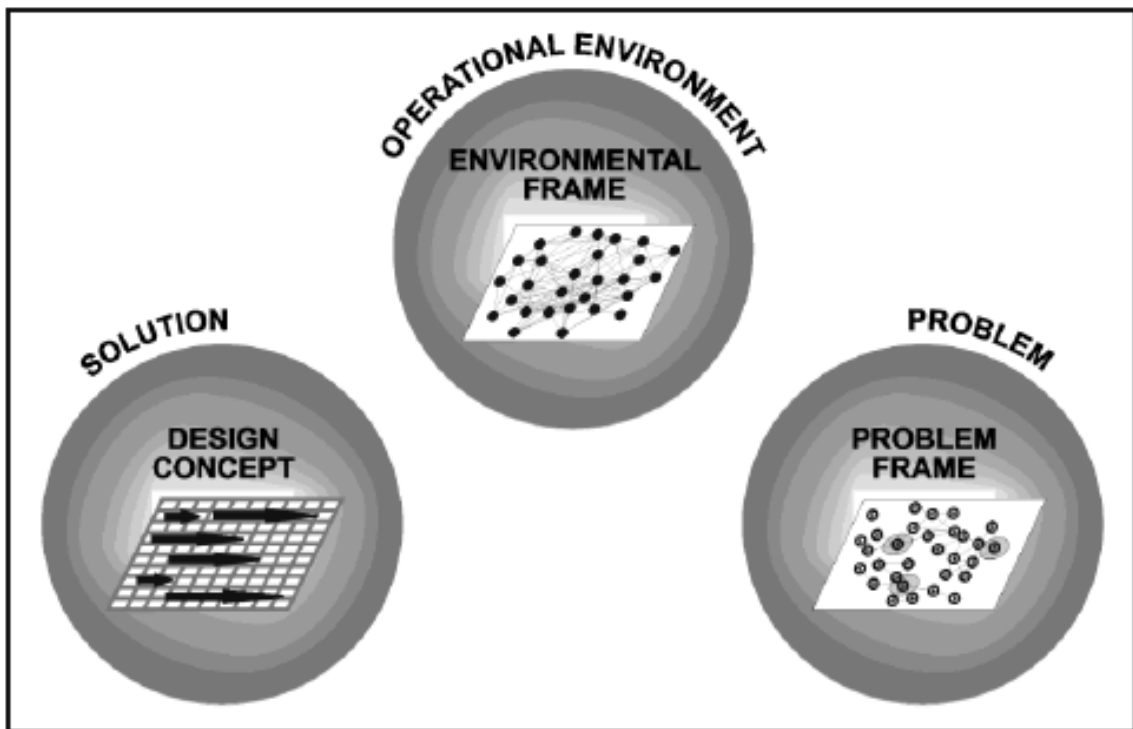
Figure 1

Army

The army approach to design is sounder than the Marine Corps version contained in the draft version of MCPP. The Army developed a design approach from the ground up, vice attempting to force it into the old planning process. The Army approach is well-researched and rooted in systems theory. There are, however, three problems with the Army version. First, it is rather academic and difficult to understand. Second, there is little focus on the desired state.

Figure 1 shows a visual representation of the Army's approach to design.[10] In this

representation, there is no visual depiction of the desired state. Finally, there is no process

outlined. None of the design literature produced by either the Army or Marine Corps lists a

process for design. The services list no process out of fear of appearing procedural. Without a

process, however, planners do not understand how to design or where to begin. The next section

will propose a non-procedural process for operational design that focuses on the purpose found

in the desired state. The process is easy to understand and apply by planners at all levels.

Solution: Simple Design Model and Process

Design is a conceptual tool that planners can apply to any complex problem, regardless of

scope. The intent is to develop a shared understanding of the situation and problem by thinking

holistically, creatively and critically. The commander is essential to the design process, and

must foster a climate that encourages honest, candid discourse as well as innovative thinking.

Planners can apply the process over long or short time horizons. The longer the time horizon,

however, the more planners will need to redesign.

Planners at all levels can use design to solve problems. Some have argued that planners

should only use design on upper level staffs, such as the division and combatant command level.

To the contrary, the situations faced by battalions and companies are so complex and regionally

varied that design is required at these lower levels as well. Planners can successfully implement

design at these lower levels if given a clear, simple process and model.

The design model described below presents design in a manner that is simple and easy to

understand, with a defined process. There are two major differences between this process and

other military processes. First, there is no checklist of steps or detailed regulations governing the

process. Instead, design is non-procedural process. Second, there is no "cookie-cutter" approach. Often times, military planners try to fit every situation in a pre-made model or use pre-made tools. Some of these tools appear on the surface to help, but in the end can limit the planner's creativity because they do not fully encompass the complexity of the situation. Instead, the design process relies on a holistic understanding of the situation to synthesize the models tailored to the situation.
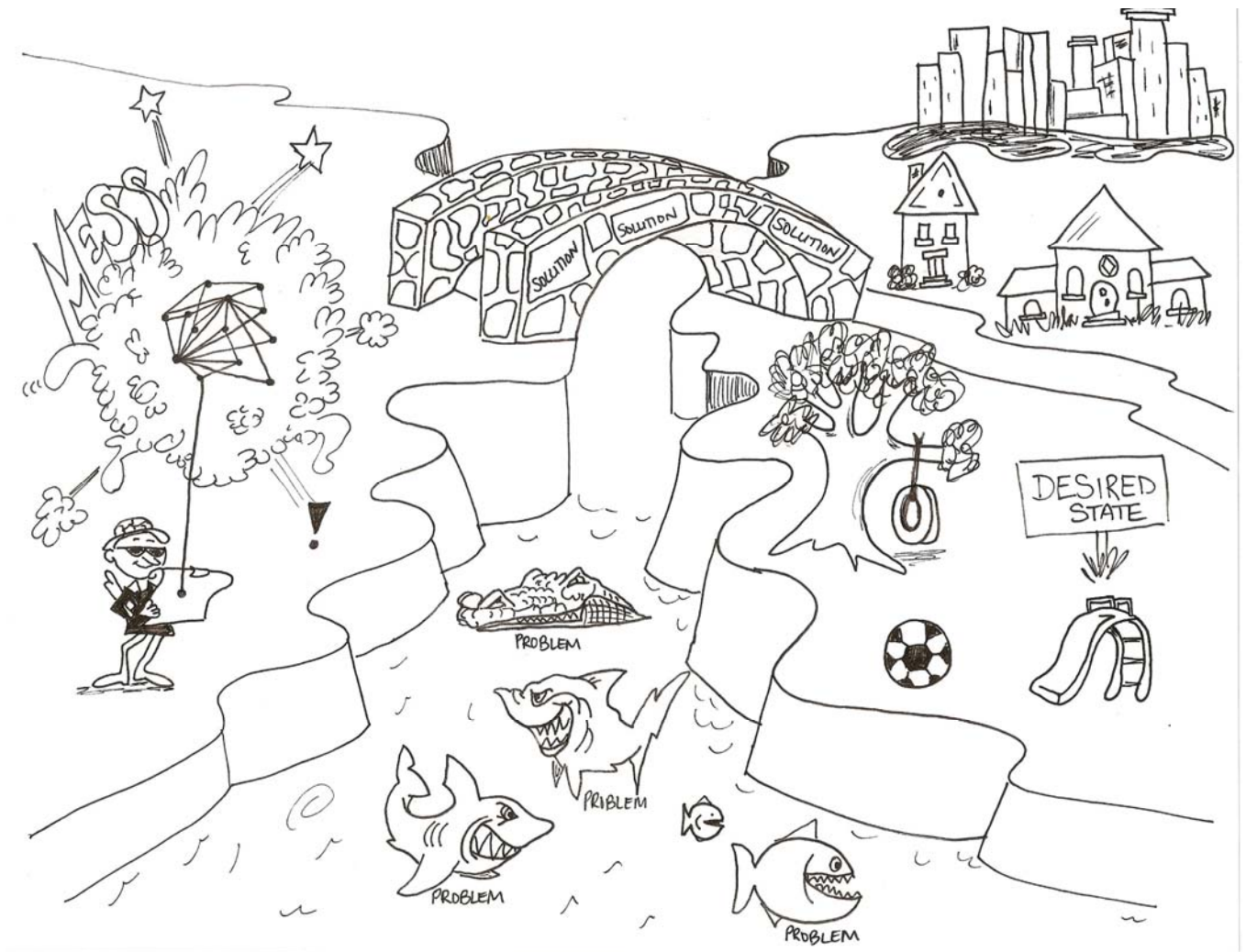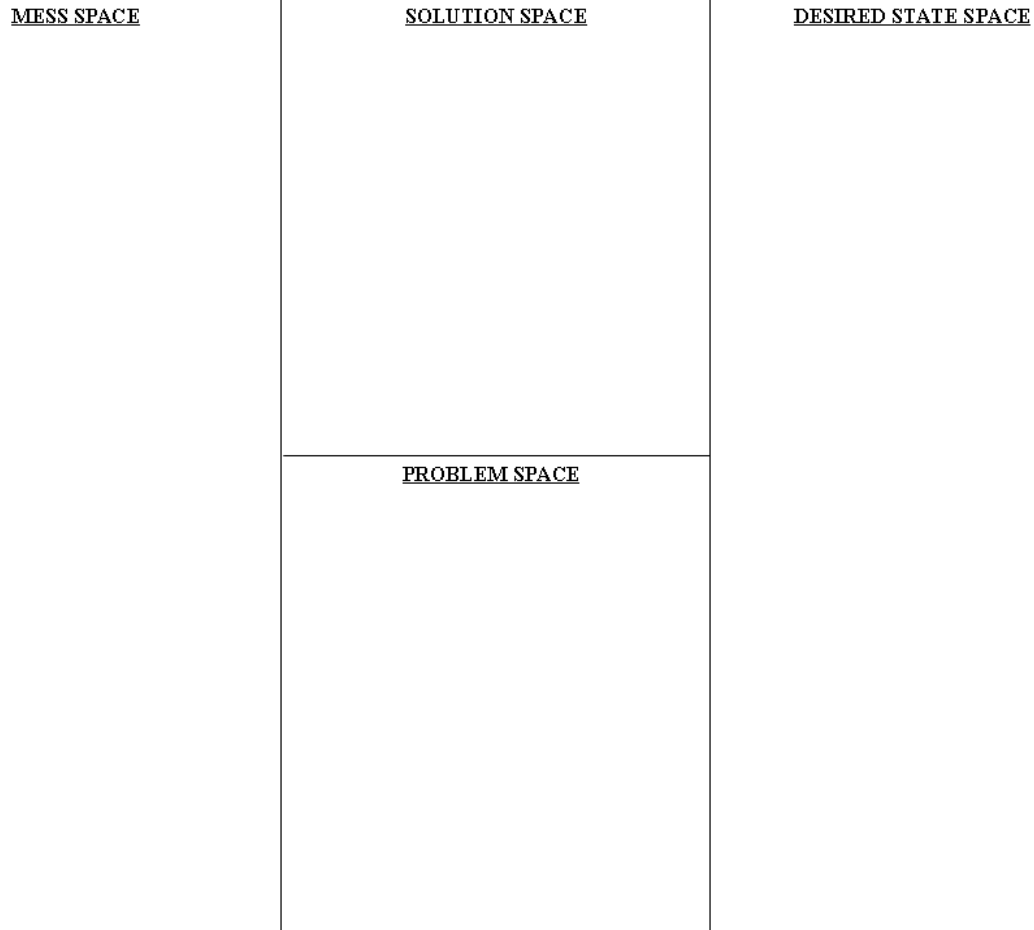

Figure 2

MESS SPACE | SOLUTION SPACE | DESIRED STATE SPACE

PROBLEM SPACE

Figure 3

To understand how to design, it helps to form a mental model of the design process; shown mapped to paper in Figure 2.[11] The design mental model easily maps to a blank canvas for use during design. Figure 3 shows the blank canvas. The designer decides what goes into the spaces. Methods for filling the spaces range from simple discourse to systems models. Other methods include brainstorming, sketching, concept maps, mind maps, and system dynamics models. The model contains four spaces: problems, solutions, mess, and desired state. Next, the paper will explain the non-procedural process followed by the four design spaces. Then, the paper will explain how to view the four design spaces in a holistic fashion to develop a sensible

story, and the importance of viewing design as an iterative learning process. This section ends with a look at the typical outputs of the design process.

Non-Procedural Process

   Design is a non-procedural process. There are no numbered steps, and planners are free to work in any space they choose, an act forbidden in the lockstep, rational decision-making process where planners cannot offer solutions until they have analyzed the mission and "understand" the problem. Studies show that creating solutions and contemplating their effects *is* how planners understand complex problems and demonstrates creative learning.[12] Therefore, this jumping from space to space is actually encouraged and seen as normal behavior in the design process. Figure 4 shows the design pattern of cognitive activity, which compares a linear approach to problem solving with a design approach to problem solving.[13] This movement around the design space is important because the problems are interrelated. As planners create solutions to problems in one area, planners may anticipate how these effects cascade into other problem areas and change the way they deal with those problems.
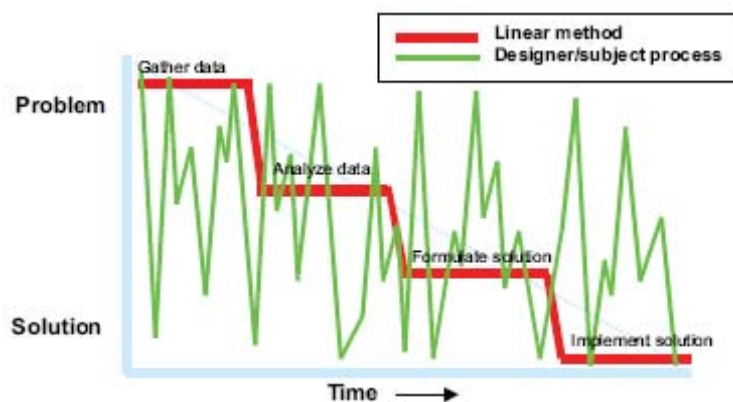

Figure 4

Desired State Space

Constructing the desired state is a systemic process and is included as a space in the model. The term, desired state, has near synonymous meaning to "end state"; however, it is a better term because it more accurately represents the dynamic nature of the situation that will continue to evolve, even if the situation reaches the desired or "end" state. Planners design their desired state by considering guidance and constraints from higher and ideations formed during the design process. Planners design the desired state on the premise that they need to understand where they want to go in order to figure out how to get there. As Yogi Berra said, "If you don't know where you are going, you might wind up someplace else."

Designing the desired state is the focal point in the design process because it defines the purpose. Understanding the purpose is a very powerful concept. Commanders realize this importance when they give commander's intent consisting of a task and, most importantly, a purpose. Commander's intent enables subordinate leaders to act and accomplish the intent of the mission by changing the plan when they cannot accomplish the task as specified, or when they realize that the task will not accomplish the purpose.

Purpose also defines how systems self-organize. Purpose explains why parts of a system do what they do. The purpose is the source of complex behavior. When people understand the system's purpose, the behavior makes sense and seems simple. An example will clarify this principle.

A rifle platoon tasked with securing a border "rat-line" to prevent the flow of weapons and foreign fighters from entering the country comes under constant attack from one of the local tribes they assumed were friendly. Intelligence reports from other units in the area confirm growing hostilities from the tribesmen toward the Americans. The platoon does not understand

the behavior and assumes the tribe has joined the insurgency. During an interrogation of a tribesman taken prisoner in an engagement, the platoon learns that the tribe's livelihood focuses on smuggling sheep across the border and that this livelihood was no longer possible with their smuggling routes secured. The complex, violent behavior of the tribe now makes sense when viewed in light of their purpose of removing the Americans from the smuggling routes. The tribe's desired state, among other things, was to continue their age-old practice of smuggling sheep to the neighboring country. As will be shown in the next section, designing the desired state *is* the design process.

MESS SPACE

Relevant Actors

Actor 1

History

MESS SPACE	SOLUTION SPACE	DESIRED STATE SPACE

Environment

PROBLEM SPACE

Physical Terrain

Relevant Actors

Actor 2

Cultural Terrain

MESS SPACE	SOLUTION SPACE	DESIRED STATE SPACE

Resources Available

PROBLEM SPACE

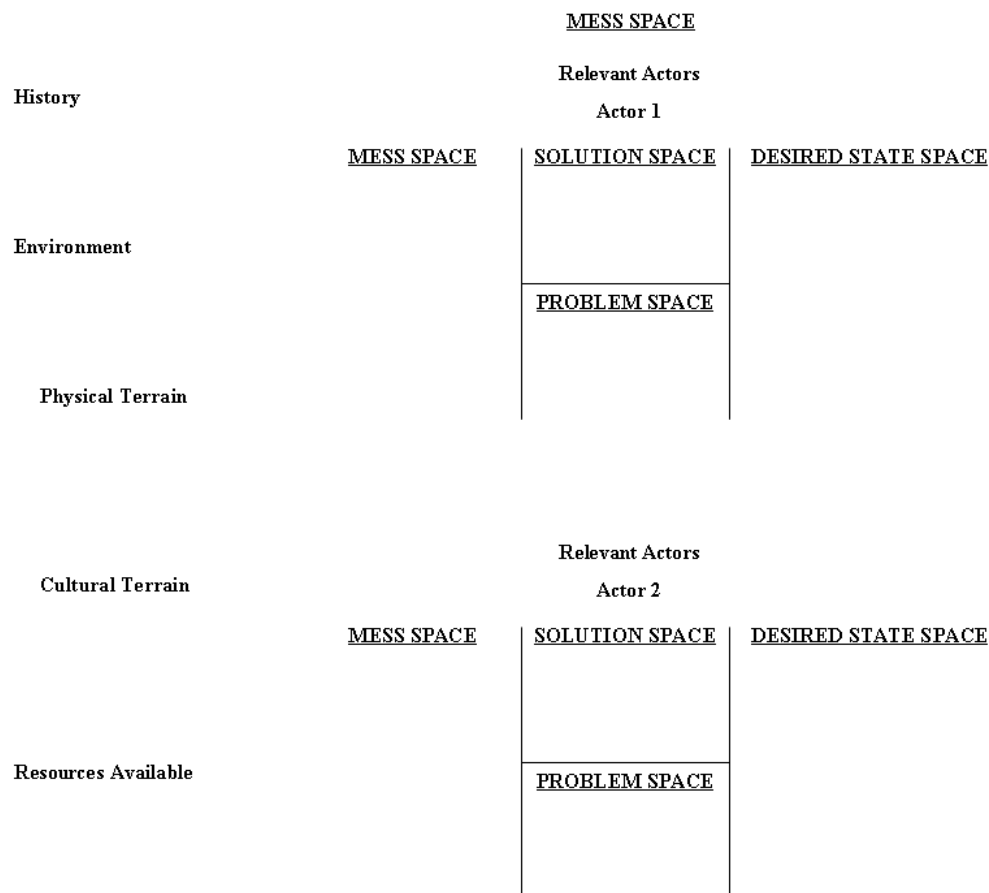Figure 5

Mess Space

In the complicated mess space, planners look to understand the current situation. Russell Ackoff uses the term "mess" to describe "...a system of external conditions that produces dissatisfaction" and states that it forms a "...set of interrelated problems" vice a single problem.[14] As shown in Figure 2, once planners interact with the mess, they become part of the mess. Planners focus on the history of the area, the environment to include the physical and cultural terrain, the resources available to them, and all relevant actors in the area. Figure 5 shows an expansion of the mess space with these parameters listed. Typically, planners struggle most with understanding the relevant actors and their interactions with one another, which is where the complexity and messiness build, because these actors are all complex adaptive systems with free will. However, when planners realize the actors organize around a purpose, their behavior begins to make sense.

The best way to understand the purpose of the actors is by understanding their desired state. Often, planners can understand the actor's desired state from their strategic communication messages. Planners can also ask the actors what their desired state is, and they are often very willing to answer. An example includes planners sitting down with a *Jirga* and asking the tribal elders to describe their future desired state.

Planners use the same design process and model to understand each individual actor as they did to understand their overall operational design. This approach forms a basic fractal pattern in the design process, where the design model in Figure 3 repeats itself for each actor in the mess space. Figure 5 shows this fractal pattern applied to each actor. By looking at the four design spaces from each actor's perspective, planners can understand the purpose of their action, likely actions they will take to achieve their purpose, and the problems they will need to

overcome. This approach allows planners to identify possible problems and solutions in their own design spaces.

Problem Space

        To understand the problem space, it important to first define what a problem is. Don Gause defines a problem as the "perceived difference between what things are and what things should be."[15] This definition relates to the design model by comparing the mess space, what things are, to the desired state space, what things should be. By understanding the desired state, planners begin to see the problems.

        Other terms relating to problems commonly used in design are problem setting and problem framing. Donald Schon states that, "Problem setting is the process in which, interactively, we *name* the things to which we will attend and *frame* the context in which we will attend to them."[16] This definition brings to light the fact that understanding the problem is not simply identifying the problem, but also the context, or lens, through which planners see the problem. For example, planners may frame the uprising in Iran as a revolution or civil war, while the Iranian Government may frame it as an insurgency or even terrorism. The way planners frame a problem will directly influence the solutions created. Planners need to be aware that, because they often subconsciously frame problems, they need to search for and critically consider alternative frames.

        During the design process, planners will find problems that are extremely difficult and seemingly impossible to solve. While they will be tempted to gloss over these problems, they instead need to capture them and write them in the problem space. Often, these are root

problems requiring solutions for long-term sustainability and success. Contemporary examples include fixing the Afghan government and providing sustainable jobs to the Afghan people.

Solution Space

Planners write possible solutions in the solution space. In considering possible solutions, they need to realize that some problems are extremely difficult to solve even when understood. Solutions to these problems often require them to dig deeper into history and culture for possible solutions. To use an example from Afghanistan, planners could look to the pre-Soviet invasion period to understand how governmental and agricultural systems functioned. They should also recognize when the root problems are beyond their area of expertise and seek civilian expertise. Planners typically synthesize the solutions into Lines of Operation (LOOs), as will be shown in the design output section.

A Holistic Approach: Synthesizing a Sensible Story

As stated previously, design is a holistic process where the interactions between the actors matter. Looking at the interaction between the interdependent actors is a messy process. However, Professor Roger Martin states that "Designers embrace the mess" and that the mess is the "Most realistic source of creative opportunity."[17] By looking at the interactions between the actors, planners can develop innovative solutions to the problems at hand. Planners find these innovative solutions by looking at the similarities and differences between the actor's problems, solutions, and desired states.

Commonalities in desired states are sources for integration of actors along these lines. Turning and integration of the enemy is often more effective than killing the enemy. As Sun Tzu

said, "For to win one hundred victories in one hundred battles is not the acme of skill. To subdue the enemy without fighting is the acme of skill."[18] Interagency actors and allies must also integrate and synchronize along a shared common vision and desired state.

When actors have competing solutions and lines of operation, planners can pit competing actors against one another and form a wedge between them. An example is the Sunni Awakening in Iraq. Al Qaeda and Sunni Tribesman both competed for the smuggling routes as a means of making money. This competition, along with Al Qaeda violence, allowed coalition forces to form a wedge between the tribesman and Al Qaeda. This approach follows the Arabic proverb that "The enemy of my enemy is my friend." Planners should look to attack the enemy along his LOOs as possible solutions for his solution space.

The way the actors interact with each other and their environment is similar to predator/prey models in ecology.[19] Ecologies are unpredictable, dynamic, and evolutionary. The purpose, or desired state, drives the actors and their actions. Complex adaptive systems like humans can alter their purpose. By focusing on these purposes, planners can drive the system toward their desired state. The key is integrating similarities and changing the differences, which requires understanding, compromise, and empathy.

Iterative Learning Process

Design is an iterative, continuous learning process. As planners begin to look at the actors and interaction between the actors, they will change design spaces in their plan and in the plan of other actors. These changes occur because all of the actors are interrelated, the effects cascade throughout the system, and planners begin to see unintended consequences of actions.

Planners will never fully understand the situation, especially during the planning process. They need to understand this uncertainty and always look to learn about the situation. This learning process continues into the detailed planning process and war-gaming. As knowledge and understanding improve, the planners will need to update the design and plan. This updating is particularly true during execution. During execution, commanders begin to learn a great deal about their environment and the actors in it. Most learning occurs from the bottom up and this feedback forms the control in command and control.[20] The actors also begin to adapt and the need to update the design, and possibly redesign, is apparent. Commanders should be particularly wary during times of failure or success. There may have been a tipping point, also called a phase change, which occurred in the system that may greatly change the way the system behaves. Commanders should encourage subordinates to experiment in a controlled fashion as a means of learning that may be applicable on a higher level.

Design Outputs

Design, and planning in general, is more about the process and the learning that takes place than the product. However, the products are helpful and aid planners in their detailed planning. The output of the design process is a story that explains how planners move from the mess to the desired state. Planners synthesize the story from the four design spaces while weaving a description of each space into the story. The story can be in narrative and/or graphic form. Figure 6 is a graphical form of the operational design graphic for 1st Marine Division during Operation Iraqi Freedom II.[21] Other outputs normally associated with the design process include a mission statement, commander's intent, an outline of the concept of operations, the

commander's initial planning guidance, and a warning order. Planners can then use the design outputs for detailed planning.
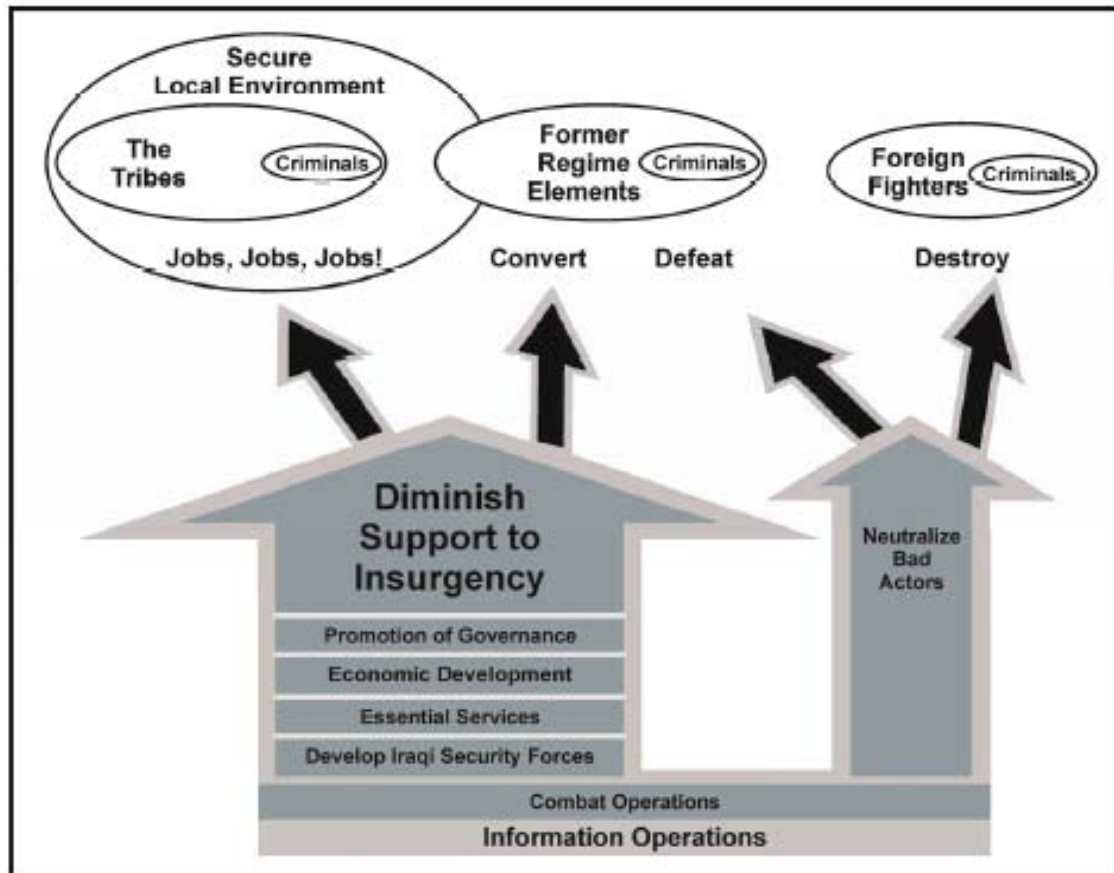

Figure 6

Conclusion

In conclusion, the irregular wars fought in Iraq and Afghanistan since 2001 have highlighted the need for a new approach to planning when facing ill-structured problems. Operational design is a suitable approach; however, implementation has fallen short and the Army and Marine Corps both need a simple model and process for explaining operational design. The irregular wars in Iraq and Afghanistan have shown that MCPP is inadequate for

handling ill-structured problems. Planners must understand whether they are facing a structured or ill-structured problem, so that they can apply the proper solution method. Ill-structured problems require a synthetic problem solving approach, such as design, to understand the interactively complex situation, define the root problems, and devise innovative solutions. The Army and Marine Corps have recently started the transition to operational design; however, both approaches have implementation problems, mostly stemming from a lack of a simple model and process. This paper details a simple, non-procedural design process and model that focuses on designing the desired state. This simple design process and model makes the powerful tool of design easy to teach, understand, and apply by planners at all levels.

Notes

[1] U.S. Army, Training and Doctrine Command, *Commander's Appreciation and Campaign Design,* TRADOC Pamphlet 525-5-500, (Fort Monroe, VA: United States Army, Training and Doctrine Command, January 28, 2008) 5-7 .

[2] U.S. Marine Corps, Combat Development Command, *A Tentative Manual for Countering Irregular Threats* (Quantico, VA: United States Marine Corps, Combat Development Command, June 7, 2006), 2.

[3] Simon, Herbert. *The Sciences of the Artificial*, third ed. (Cambridge, Massachusetts: The MIT Press, 1996).

[4] Horst W. J. Rittel. "On the Planning Crisis: Systems Analysis of the 'First and Second Generations,'" *Bedriftsøkonomen*, no. 8 (1972): 390-396

[5] Jeffrey Conklin. *Dialogue Mapping: Building Shared Understanding of Wicked Problems*, (Chichester, England: John Wiley & Sons, 2006), 9-10.

[6] Horst W. J. Rittel and Melvin M. Webber. "Dilemmas in a General Theory of Planning," *Policy Science*, no. 4 (1973): 155-169.

[7] Russell Ackoff, Jason Magidson, and Herbert Addison. *Idealized Design: How to Solve Tomorrow's Crisis Today* (Upper Saddle River, New Jersey: Wharton School Publishing 2006), 104.

[8] Headquarters U.S. Marine Corps. *Marine Corps Planning Process (Functional Working Draft).* MCWP 5-1. (Washington,DC: Headquarters U.S. Marine Corps, August 2009), 6.

[9] Headquarters U.S. Marine Corps. *Marine Corps Planning Process (Functional Working Draft),* 3-4.

[10] Department of the Army. *Design*. FMI 5-2. (Washington, DC.: U.S. Department of the Army, February 20, 2009), 18 .

[11] Melanie Stofka, a professional artist, assisted Major Jon Stofka in the drawing of the design mental model.

[12] Conklin, 5-6.

[13] Conklin, 5.

[14] Russell Ackoff, *Redesigning the Future: A Systems Approach to Societal Problems* (New York: John Wiley and Sons 1974), 21.

[15] Donald Gause and Gerald Weinberg, *Your Lights On?: How to Figure Out What the Problem Really Is* (New York: Dorsett Publishing 1990), 15-28.

[16] Donald A. Schon, *The Reflective Practioner: How Professionals Think In Action* (New York: Basic Books 1983), 40.

[17] Roger Martin, *The Design of Business: Why Design Thinking is the Next Competitive Advantage* (Cambridge, Massachusetts: Harvard Business Press 2009).

[18] Sun Tzu, *The Art of War*, trans. Samuel B. Griffith (New York: Oxford University Press, 1963), 77.

[19] Headquarters U.S. Marine Corps, *Strategy,* MCDP 1-1 (Washington, DC: U.S.Marine Corps, November 12, 1997), 17-19.

[20] Headquarters U.S. Marine Corps, *Command and Control,* MCDP 6 (Washington, DC: U.S.Marine Corps, October 4, 1996), 39-41.

[21] U.S. Department of the Army, and Headquarters U.S. Marine Corps, *Counterinsurgency,* FM 3-24 or MCWP 3-33.5. (Washington, DC: U.S. Department of the Army, December 2006), 4-8.

Bibliography

Ackoff, Russell. *A Concept of Corporate Planning*. New York: Wiley Interscience, 1970.

Ackoff, Russell. *Redesigning the Future: A Systems Approach to Societal Problems*. New York: John Wiley & Sons, 1974.

Ackoff, Russell and Daniel Greenberg. *Turning Learning Upside Up: Putting Education Back on Track.* Upper Saddle River, New Jersey: Wharton School Publishing, 2008.

Ackoff, Russell, Jason Magidson, and Herbert Addison. *Idealized Design: How to Solve Tomorrow's Crisis Today.* Upper Saddle River, New Jersey: Wharton School Publishing, 2006.

Alberts, David, and Thomas J. Czerwinski, eds. *Complexity, Global Politics, and National Security.* Washington, D.C.: National Defense University, 1997. http://purl.access.gpo.gov/GPO/LPS2419 (accessed October 1, 2009).

Australian Public Service Commission. *Tackling Wicked Problems: A Public Policy Perspective.* Canberra: APSC, 2007 http://www.apsc.gov.au/publications07/wickedproblems.pdf (accessed January 20, 2010).

Boland, Richard and Fred Collopy. *Managing as Designing*. Stanford, California: Standord University Press, 2004.

Banach, Stefan "Educating By Design: Preparing Leaders For a Complex World." *Military Review 89*, no.3 (March-April 2009): 96-104.

Banach, Stefan and Alex Ryan. "The Art of Design: A Design Methodology." *Military Review 89,* no.3 (March–April 2009): 105–115.

Barabási, Albert-László. *Linked: How Everything Is Connected to Everything Else and What It Means for Business, Science, and Everyday Life*. Cambridge, Massachusetts: Perseus, 2002.

Bertalanffy, Ludwig von. *General System Theory: Foundations, Development, Applications*. New York: George Braziller, Inc., 1968.

Beyerchen, Alan. "Clausewitz, Nonlinearity, and the Unpredictability of War." *International Security*, Winter 1992/93:59-90.

Bird, Alexander. "Thomas Kuhn", *The Stanford Encyclopedia of Philosophy* (Fall 2008Edition), http://plato.stanford.edu/entries/thomas-kuhn (accessed January 20, 2009).

Brown, Tim. *Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation*. New York: Harper Collins, 2009.

Checkland, Peter ed. *Systems Thinking, Systems Practice*. Chichester, England: John Wiley & Sons, 1999.

Clausewitz, Carl von: *On War*. Edited by Michael Howard and Peter Paret. Translated by Michael Howard and Peter Paret. Princeton, NJ: Princeton University Press, 1984.

Conklin, Jeffrey. *Dialogue Mapping: Building Shared Understanding of Wicked Problems*, Chichester, England: John Wiley & Sons, 2006.

De Czege, Huba Wass. "Systemic Operational Design: Learning and Adapting In Complex Missions." *Military Review* 89, no.1 (January-February 2009): 2-12.

Duggan, William. *Coup D'Oeil: Strategic Intuition in Army Planning*. Carlisle, Pennsylvania: U.S. Army War College, Strategic Studies Institute, November 2005.

Department of the Army. *Operations*. FM 3-0. Washington, DC.: U.S. Department of the Army, 27 February 2008.

Department of the Army, and Headquarters U.S. Marine Corps. *Counterinsurgency*. FM 3-24 or MCWP 3-33.5. Washington, DC.: U.S. Department of the Army, 15 December 2006.

Department of the Army. *Design*. FMI 5-2. Washington, DC.: U.S. Department of the Army, 20 February 2009.

Department of the Army. *Design*. Issue paper: Army Design Doctrine. Washington, DC.: U.S. Department of the Army, 29 March 2009.

Dorner, Dietrich. *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations*. Reading, Massachusetts: Addison-Wesley, 1996.

Gause, Donald and Gerald Weinberg. *Are Your Lights On?: How to Figure Out What the Problem Really Is.* New York: Dorsett Publishing, 1990.

Gharajedaghi, Jamshid. *Systems Thinking: Managing Chaos and Complexity*. Boston, Massachusetts: Butterworth Heinemann, 1999.

Gleick, James. *Chaos*. New York: Penguin Books, 1987.

Gell-Mann, Murray. *The Quark and the Jaguar: Adventures in the Simple and the Complex*. New York: W.H. Freeman and Company, 1994.

Kem, Jack D., *Design: Tools of the Trade*. Fort Leavenworth, Kansas: U.S. Army Command and General Staff College, U.S. Army Combined Armed Center, May 2009.

Klein, Gary. *Sources of Power: How People Make Decisions*. Cambridge, Massachusetts: The MIT Press, 1998.

Kuhn, Thomas S. *The Structure of Scientific Revolutions*. Chicago: The University of Chicago Press, 1962.

Headquarters U.S. Marine Corps. *Command and Control.* MCDP 6. Washington, DC: Headquarters U.S. Marine Corps, October, 4 1996.

Headquarters U.S. Marine Corps. *Marine Corps Planning Process.* MCWP 5-1. Washington, DC: Headquarters U.S. Marine Corps, January 5, 2000.

Headquarters U.S. Marine Corps. *Marine Corps Planning Process (Functional Working Draft).* MCWP 5-1. Washington,DC: Headquarters U.S. Marine Corps, August 2009.

Headquarters U.S. Marine Corps. *Planning.* MCDP 5. Washington, DC: Headquarters U.S. Marine Corps, July 21, 1997.

Headquarters U.S. Marine Corps. *Strategy.* MCDP 1-1. Washington, DC: Headquarters U.S. Marine Corps, November 12, 1997.

Headquarters U.S. Marine Corps. *Warfighting* MCDP 1. Washington, DC: Headquarters U.S. Marine Corps, June 20, 1997.

Martin, Roger. *The Design of Business: Why Design Thinking is the Next Competitive Advantage*. Cambridge, Massachusetts: Harvard Business Press, 2009.

Pagels, Heinz. *The Dreams of Reason: The Computer and the Rise of the Sciences of Complexity.* New York, NY: Bantam Books, 1989.

Rittel, Horst W. J. and Melvin M. Webber. "Dilemmas in a General Theory of Planning," *Policy Science*, no.4 (1973), 155-169.

Rittel, Horst W. J. "On the Planning Crisis: Systems Analysis of the 'First and Second Generations,'" *Bedriftsøkonomen*, no. 8 (1972), 390-396.

Schaefer, C. 2009. "Design Extending Military Relevance." *Military Review* 89, no.5 (September-October 2009): 29-39.

Schmitt, John. "Command and (Out of) Control: The Military Implications of Complexity Theory."In *Complexity, Global Politics, and National Security*, edited by David Alberts and Thomas J. Czerwinski, 219-246.Washington, D.C.: National Defense University, 1997.

Schmitt, John. *A Systemic Concept for Operational Design*. Marine Corps Combat Development Command, Concepts and Plans Division, Marine Corps Warfighting Lab concept paper, August 2006, http://www.au.af.mil/au/awc/awcgate/usmc/mcwl_schmitt_op_design.pdf, (accessed January 20, 2010).

Schon, Donald A. *The Reflective Practioner: How Professionals Think In Action*. New York: Basic Books, 1983.

Senge, Peter M. *The Fifth Discipline: The Art and Practice of the Learning Organization*. New York: Doubleday/Currency, 1990.

Simon, Herbert. *The Sciences of the Artificial*, third ed. Cambridge, Massachusetts: The MIT Press, 1996.

Sun Tzu, *The Art of War*, Translated by Samuel B. Griffith. New York: Oxford University Press, 1963.

U.S. Department of the Army, and Headquarters U.S. Marine Corps. *Counterinsurgency.* FM 3-24 or MCWP 3-33.5. Washington, DC: U.S. Department of the Army, December 2006.

U.S. Army, Training and Doctrine Command. *Commander's Appreciation and Campaign Design,* TRADOC Pamphlet 525-5-500. Fort Monroe, VA: United States Army, Training and Doctrine Command, January 28,2008.

U.S. Marine Corps, Combat Development Command. *A Tentative Manual for Countering Irregular Threats*. Quantico, VA: United States Marine Corps, Combat Development Command, June 7, 2006.

Van Riper, Paul K. "An Introduction to Systems Theory and Decision-Making." Unpublished paper. Marine Corps University. 2010.

Vego, Milan. "A Case Against Systemic Operational Design." *Joint Force Quarterly: JFQ*(53), (Second Quarter):69-75.

Waldrop, M. Mitchell. *Complexity: The Emerging Science At the Edge of Order and Chaos*. New York: Simon & Schuster, 1993.